1. A flywheel energy storage device for stationary applications comprising:

a solid alloy steel flywheel, free of a center through hole, supported for rotation about a vertical axis by a five active axes magnetic bearing system, said flywheel rotating in normal operation at a peripheral speed of at least 200 meters per second;

a brushless synchronous motor and generator operatively connected to said flywheel for accelerating and decelerating said flywheel for storing and retrieving energy;

a container surrounding said flywheel and maintained with an internal vacuum for reduction of aerodynamic drag on said flywheel;

said five active axes magnetic bearing system including one upper radial magnetic bearing, one lower radial magnetic bearing and at least one axial thrust magnetic bearing;

said one upper radial magnetic bearing and said one lower radial magnetic bearing each assembled in said flywheel device and at zero rotational speed having an operating load capacity, R measured in Newtons, and said flywheel having a mass, M measured in Kilograms, wherein $0.170\ M < R < 0.838\ M$.

2. A flywheel energy storage device as described in claim 1 wherein:

said upper radial magnetic bearing and said lower radial magnetic bearing are homopolar.

3. A flywheel energy storage device as described in claim 2 wherein:

said upper radial magnetic bearing and said lower radial magnetic bearing are biased using permanent magnets.

4. A flywheel energy storage device as described in claim 2 wherein:

said upper radial magnetic bearing and said lower radial magnetic bearing are self sensing and do not require separate position sensors.

5. A flywheel energy storage device for stationary applications comprising:

a solid alloy steel flywheel without center through hole supported for rotation about a vertical axis by a five active axes magnetic bearing system, said flywheel rotating in normal operation at a peripheral speed of 200 meters per second or greater;

a brushless synchronous motor and generator means operatively connected to said flywheel for accelerating and decelerating said flywheel for storing and retrieving energy;

a container that surrounds said flywheel maintained with an internal vacuum for reduction of aerodynamic drag;

said five active axes magnetic bearing system comprising one upper radial magnetic bearing, one lower radial magnetic bearing and at least one axial thrust magnetic bearing;

said flywheel has no flexural resonance modes below its normal operating rotational speed and both said upper radial magnetic bearing and said lower radial magnetic bearing are controlled by a controller utilizing speed independent control.

6. A flywheel energy storage device as described in claim 5 wherein:

said upper radial magnetic bearing and said lower radial magnetic bearing are homopolar.

7. A flywheel energy storage device as described in claim 6 wherein:

said upper radial magnetic bearing and said lower radial magnetic bearing are biased using permanent magnets.

8. A flywheel energy storage device as described in claim 6 wherein:

said upper radial magnetic bearing and said lower radial magnetic bearing are self sensing and do not require separate position sensors.

9. A flywheel energy storage device for stationary applications comprising:

a solid alloy steel flywheel without center through hole supported for rotation about a vertical axis by a five active axes magnetic bearing system, said flywheel rotating in normal operation at a peripheral speed of 200 meters per second or greater;

a brushless synchronous motor and generator means operatively connected to said flywheel for accelerating and decelerating said flywheel for storing and retrieving energy;

a container that surrounds said flywheel maintained with an internal vacuum for reduction of aerodynamic drag;

said five active axes magnetic bearing system comprising one upper radial magnetic bearing, one lower radial magnetic bearing and at least one axial thrust magnetic bearing;

said radial magnetic bearing located on the end of the flywheel opposite the end containing the axial thrust magnetic bearing having a magnetically operative axial length, X in meters, while said flywheel has a body cylinder length, L in meters, and said flywheel rotates in normal operation with a peripheral speed, V in meters per second, wherein $X \geq 9.25\ 10^{-8}\ V^2\ L$.

10. A flywheel energy storage device as described in claim 9 wherein:

said upper radial magnetic bearing and said lower radial magnetic bearing are homopolar.

11. A flywheel energy storage device as described in claim 10 wherein:

said upper radial magnetic bearing and said lower radial magnetic bearing are biased using permanent magnets.

12. A flywheel energy storage device as described in claim 10 wherein:

said upper radial magnetic bearing and said lower radial magnetic bearing are self sensing and do not require separate position sensors.

13. A flywheel energy storage device for stationary applications comprising:

a solid alloy steel flywheel, free of any center through hole, and supported for rotation about a vertical axis by a five active axes magnetic bearing system, said flywheel rotating in normal operation at a peripheral speed of 200 meters per second or greater;

a brushless synchronous motor and generator operatively connected to said flywheel for accelerating and decelerating said flywheel for storing and retrieving energy;

a container enclosing said flywheel and maintained with an internal vacuum for reduction of aerodynamic drag;

said five active axes magnetic bearing system comprising one upper radial magnetic bearing, one lower radial magnetic bearing and at least one homopolar axial thrust magnetic bearing.

14. A flywheel energy storage device as described in claim 13 wherein:

said upper radial magnetic bearing and said lower radial magnetic bearing are homopolar.

15. A flywheel energy storage device as described in claim 14 wherein:

said upper radial magnetic bearing and said lower radial magnetic bearing are biased using permanent magnets.

16. A flywheel energy storage device as described in claim 14 wherein:

said upper radial magnetic bearing and said lower radial magnetic bearing are self sensing and do not require separate position sensors.

17. A flywheel energy storage device as described in claim 13 wherein:

said one upper radial magnetic bearing, said one lower radial magnetic bearing and said at least one axial thrust magnetic bearing are controlled by at least 5 amplifiers and at least one controller all of which are powered by one or more DC-DC converters connected to the direct current side of a synchronous inverter driving said brushless synchronous motor and generator.

18. A flywheel energy storage device as described in claim 13 wherein:

said axial thrust bearing uses an axial surface of said steel flywheel as an integral element of said axial thrust bearing, wherein flux generated in said axial thrust bearing is conducted through high permeability portions of said steel flywheel in operation of said axial thrust bearing.